Techknowlogia

EDITORIAL:
TOUCHING THE UNTOUCHABLE!
THE FUTURE IS CHANGING
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As we enter the 21st century, countries, institutions and individuals are facing daunting economic, social and developmental challenges. The workplace is becoming more knowledge and technology based. But knowledge itself, both basic and applied, is being generated very fast and is growing exponentially.

More new information has been produced within the last three decades than in the last five millennia. We should be poised for dramatic scientific advances and breakthroughs in the macro-frontiers of the universe on the one hand, and microscopic secrets of the human body on the other hand - and everything in between.

But not all generated knowledge is at the sophisticated levels. We should expect similar developments in areas related to everyday life and to the marketplace. In fact, all facets of society are becoming knowledge dependent. Moreover, participation in a modern technological world necessitates a significant level of scientific and technological understanding. This applies to all areas of everyday living, including banking, business transactions, health services, transportation vehicles, home appliances, utilities, communication and information exchange.

Science and Math for All A cursory analysis of these challenges quickly points to the crucial role of school science and mathematics in meeting them. What is not always obvious is the need to enhance science and mathematics teaching and learning for every citizen:

~College-bound graduates need a solid scientific and technological foundation that compares well with international standards, to serve as preparation for specialization in these fields and for the creation of a cadre of scientists, innovators and managers of transfer of knowledge and technology; ~Graduates entering the market place need the necessary knowledge and skills to function in the workplace and the tools to access, assess, adopt and apply new knowledge acquired through conventional and advanced means to apply in new jobs; ~All graduates need the ability to integrate knowledge from different disciplines and apply them to the solution of real-life problems, in a society that is becoming more technologically sophisticated and dependent.

Not What It Should Be

Science and mathematics are supposed to provide conceptual and technological tools that allow people to describe and explain how the world works with power and precision, and to achieve a richer understanding and appreciation of the world they experience. Unfortunately though, school conditions, in most cases, have reduced the wonderful, dynamic and multidimensional world of science into flat texts, scripted demonstrations and occasional cookbook experiments.

Similarly, the world of mathematical constructs, concepts and relationships has been transformed into drill and practice of computations and abstract problems.

What It Could Be

The integration of modern information and communication technologies (ICTs) into the teaching/learning process of science and mathematics may be the only way to recapture the real world of science and mathematics and reopen it to the learner. ICTs, properly developed and integrated into instructional activities have the potential to:

~Allow materials to be presented in multiple media for multi-channel learning;
~Motivate and engage students in the learning process; ~Bring abstract concepts to life;
~Enhance critical thinking and other higher levels of cognitive skills and processes;
~Provide opportunities for students to practice basic skills on their own time and pace;
~Allow students to utilize the information acquired to solve problems, formulate new problems, and explain the world around them;
~Provide for access to scientific research, researchers and databases;
~Bring the world into the classroom in the most cost-effective (and in some cases the only) way; and
~Offer (via Internet) teachers and students a platform through which they can communicate with colleagues from distant places, exchange work, develop research, and function as if there were no geographical boundaries.

Virtual Labs

All school systems want to provide labs because science is empirical. But few schools have them, fewer have them equipped and fewer yet are willing to risk using them. Technology allows for video and digital demonstrations as well as digital simulations of lab activities in a very real manner - but without the risks and costs associated with lab experiments. Simulations of science lab experiments could also use real data.

Datalogging is a type of software that enables the use of actual sensors and probes connected to the computer. Rather than feeding the information manually to the computer, the sensor directly uploads the measurement, thus reducing the margin of error, and reproducing a situation that is closer to an actual experiment.

Computer simulations are particularly helpful for learning science in the following situations:

~Experiments that are too risky, expensive or time consuming to be conducted in a school laboratory, such as those involving volatile gases;
~"Tidy" experiments that require precision so that students can see patterns and trends; students may not be able to achieve the necessary precision without simulation tools;
~Experiments that break the laws of nature, such as exploring kinematics collisions that violate conservation of momentum law; and
~When ethical issues are at stake, such as in the case of some biology experiments.

Simulations should not totally replace hands-on activities. They should rather prepare the learner to conduct real-life experiments - in the same manner that flight simulations prepare the student-pilot for test flying.

Beyond Replication

If technology-enhanced programs are taped classrooms, digital texts and PowerPoint transparencies, then we are missing on the tremendous potential of technologies that can animate, simulate, capture reality, add movement to static concepts, and extend our touch to the whole universe. With imagination and appropriate tools, we can steal the thunder and touch the lightening!

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